

Claims

1. A liquid crystal display apparatus comprising:
a liquid crystal layer using OCB mode liquid crystal;
a driver applying a voltage to the liquid crystal layer;
a liquid-crystal driving power supply supplying power
to the driver; and

a switch outputting an on/off signal to the driver;
characterized in that

when an off signal is output from the switch, the driver
applies a predetermined voltage which can be applied to each
of pixels of the liquid crystal layer for a predetermined time
and after the elapse of the predetermined time, stops the supply
of power to the driver from the liquid-crystal driving power
supply.

2. The liquid crystal display apparatus according to claim
1, characterized in that

a pixel electrode to which an individual voltage is applied
with respect to each pixel and an opposed electrode arranged
opposite to each pixel electrode are disposed on the liquid
crystal layer,

the predetermined voltage is a voltage equal to or higher
than a critical voltage of OCB mode liquid crystal, and

application of a voltage to each of the pixels is performed
between the pixel electrode and the opposed electrode.

3. The liquid crystal display apparatus according to claim 2, characterized in that

the predetermined voltage is a voltage at which substantially black is displayed on a display face.

4. The liquid crystal display apparatus according to claim 2, characterized in that

when an off signal is output from the switch, the driver applies a voltage at which substantially black is displayed on a display face to each of pixels of the liquid crystal layer and then, applies a voltage at which substantially white is displayed on the display face, and then stops the supply of power to the driver from the liquid-crystal driving power supply.

5. The liquid crystal display apparatus according to claim 2, characterized in that

when an off signal is output from the switch, the driver applies a voltage higher than a voltage at which substantially black is displayed on a display face, to each of pixels of the liquid crystal layer for predetermined time instead of applying a predetermined voltage to each of the pixels and after the elapse of predetermined time, stops the supply of

power to the driver from the liquid-crystal driving power supply.

6. The liquid crystal display apparatus according to claim 2, characterized in that

when an off signal is output from the switch, the driver applies a voltage higher than a voltage at which substantially black is displayed on a display face, to each of pixels of the liquid crystal layer for predetermined time instead of applying the predetermined voltage to each of the pixels and after the elapse of the predetermined time, applies a voltage at which substantially white is displayed on the display face to each of the pixels, and then stops the supply of power to the driver from the liquid-crystal driving power supply.

7. The liquid crystal display apparatus according to claim 6, characterized in that

after the elapse of predetermined time, a voltage at which substantially black is displayed on a display face is applied instead of applying the voltage at which substantially white is displayed on the display face.

8. The liquid crystal display apparatus according to claim 2, characterized in that

when an off signal is output from the switch, the driver applies a voltage higher than a voltage at which substantially black is displayed on a display face and equal to or lower than a maximum voltage which can be applied to the liquid crystal layer, to each of pixels of the liquid crystal layer for predetermined time instead of applying the predetermined voltage to each of the pixels and after the elapse of the predetermined time, applies a voltage at which substantially black is displayed on the display face, after the voltage at which substantially black is displayed on the display face is applied, applies a voltage at which substantially white is displayed on the display face, and after the voltage at which substantially white is displayed is applied, stops the supply of power to the driver from the driving power supply.

9. The liquid crystal display apparatus according to claim 4, characterized in that

the voltage at which substantially white is displayed on the display face represents that a voltage between the opposed electrode and the pixel electrode, and a voltage between a gate line and the pixel electrode or a voltage between the pixel electrode and an electrode other than the pixel electrode are substantially zero.

10. The liquid crystal display apparatus according to claim 6, characterized in that

the voltage at which substantially white is displayed on the display face represents that a voltage between the opposed electrode and the pixel electrode, and a voltage between a gate line and the pixel electrode or a voltage between the pixel electrode and an electrode other than the pixel electrode are substantially zero.

11. The liquid crystal display apparatus according to claim 7, characterized in that

the voltage at which substantially white is displayed on the display face represents that a voltage between the opposed electrode and the pixel electrode, and a voltage between a gate line and the pixel electrode or a voltage between the pixel electrode and an electrode other than the pixel electrode are substantially zero.

12. The liquid crystal display apparatus according to claim 8, characterized in that

the voltage at which substantially white is displayed on the display face represents that a voltage between the opposed electrode and the pixel electrode, and a voltage between a gate line and the pixel electrode or a voltage between

the pixel electrode and an electrode other than the pixel electrode are substantially zero.

13. The liquid crystal display apparatus according to claim 2 further comprising a backlight connected to the liquid-crystal driving power supply to irradiate the liquid crystal layer, characterized in that

when an off signal is output from the switch, irradiation from the backlight is stopped simultaneously when or before a predetermined voltage is applied to each of pixels of the liquid crystal layer from the driver.

14. The liquid crystal display apparatus according to claim 3 further comprising a backlight connected to the liquid-crystal driving power supply to irradiate the liquid crystal layer, characterized in that

when an off signal is output from the switch, irradiation from the backlight is stopped simultaneously when or before a predetermined voltage is applied to each of pixels of the liquid crystal layer from the driver.

15. The liquid crystal display apparatus according to claim 4 further comprising a backlight connected to the liquid-crystal driving power supply to irradiate the liquid crystal layer, characterized in that when an off signal is

output from the switch, irradiation from the backlight is stopped simultaneously when or before a predetermined voltage is applied to each of pixels of the liquid crystal layer from the driver.

16. The liquid crystal display apparatus according to claim 5 further comprising a backlight connected to the liquid-crystal driving power supply to irradiate the liquid crystal layer, characterized in that when an off signal is output from the switch, irradiation from the backlight is stopped simultaneously when or before a predetermined voltage is applied to each of pixels of the liquid crystal layer from the driver.

17. The liquid crystal display apparatus according to any one of claims 2 to 16, characterized in that
the voltage to be applied to each of pixels is an alternating voltage.

18. The liquid crystal display apparatus according to any one of claims 2 to 16, characterized in that
the predetermined voltage is a uniform voltage for each of the pixels.

19. The liquid crystal display apparatus according to claim 17, characterized in that

the predetermined voltage is a uniform voltage for each of the pixels.

20. The liquid crystal display apparatus according to claim 1, characterized in that

the liquid crystal layer is provided with a pixel electrode which is connected to the driver and to which a pixel voltage is supplied and a specific electrode which is connected to the driver, to which a voltage different from the pixel voltage is supplied, and which is disposed via a dielectric so as to be opposed to the pixel electrode,

the pixel electrode is disposed so that at least a part of the contour of the pixel electrode is not vertical to the oriented direction of the OCB mode liquid crystal,

when an off signal is output from the switch, the driver generates an electric field in a direction different from the oriented direction of the OCB mode liquid crystal between the pixel electrode and the specific electrode and after the elapse of predetermined time, stops the supply of power to the driver from the liquid-crystal driving power supply.

21. The liquid crystal display apparatus according to claim 20, characterized in that

the contour of the pixel electrode includes a first portion which generates an electric field not vertical to the oriented direction of the OCB mode liquid crystal but in a direction of twisting a part of the oriented-directional liquid crystal in one direction in a pixel and a second portion which generates an electric field in a direction of twisting another part of the oriented-directional liquid crystal in other direction.

22. The liquid crystal display apparatus according to claim 21, characterized in that

the first portion and the second portion are substantially parallel with the oriented direction of the OCB mode liquid crystal and alternately continuously formed.

23. The liquid crystal display apparatus according to claim 20, characterized in that

an opposed electrode arranged opposite to each of the pixel electrodes is further disposed on the liquid crystal layer,

when an off signal is output from the switch, the driver applies a voltage for substantially white display on a display face, between each of the pixel electrodes of the liquid crystal layer and the opposed electrode, thereafter, stops the supply of power to the driver from the liquid-crystal driving power supply.

24. The liquid crystal display apparatus according to claim 20, characterized in that

when an off signal is output from the switch, the driver applies a predetermined voltage equal to or higher than a critical voltage of the OCB mode liquid crystal but equal to or lower than the maximum voltage which can be applied to the liquid crystal layer to each of pixels of the liquid crystal layer, thereafter, applies a voltage for substantially white display on a display face, thereafter stops the supply of power to the driver from the liquid-crystal driving power supply.

25. The liquid crystal display apparatus according to claim 24, characterized in that

an electric field in a direction different from the oriented direction of the OCB mode liquid crystal is applied simultaneously when or after the voltage for white display on the display face is applied.

26. The liquid crystal display apparatus according to claim 20, characterized in that

two pixel electrodes adjacent in the oriented direction of the OCB liquid crystal mode are arranged on the specific electrode via a dielectric, and

contours of the two pixel electrodes are arranged so that they are not vertical to the oriented direction of the OCB mode liquid crystal and include a first portion of generating an electric field in a direction of twisting a part of the oriented-directional liquid crystal in one direction in a pixel and a second portion of generating an electric field in a direction of twisting another part of the oriented-directional liquid crystal in other direction.

27. The liquid crystal display apparatus according to claim 26, characterized in that

the driver applies voltages having phases opposite to each other to the two pixel electrodes.